Evolutionary and Anthropological Approaches Towards Understanding Human Need for Psychotropic and Mood Altering Substances

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Abstract—Human addiction to psychotropic and mood altering substances is an ongoing international problem. While the phenomenon of psychoactive drug use has received considerable theoretical attention there need to be more comparative approaches into this area. Evolutionary and anthropological approaches for understanding human need for psychotropic and mood altering substances offer the reader various insightful angles for analyzing this phenomenon. While evolutionary approaches investigate the evolutionary behaviors and mechanisms of human ancestral psychotropic use, anthropological approaches emphasize the social and religious meanings of individual drug use. While each approach proffers different ideas, a comparative approach, which is utilized in this study, may provide a novel and invaluable insight for understanding human need for psychotropic and mood-altering substances.

Keywords—anthropology, evolution, history, nootropic drugs, psychotropic and mood altering substances

Human addiction to psychotropic and mood-altering substances is an ongoing international problem. From 1998 to 2002, Europe, Asia and Australia had widespread opiate addiction while cocaine use was predominant in South America (Saah 2005). The use of various psychotropic substances such as cocaine, cannabis, heroin, amphetamines, and others continue to be popular with increasing morbidity and mortality. The World Health Organization reported that approximately 200,000 deaths were attributed to drug use in 2000 (Saah 2005). Statistics of abuse of psychotropic and mood altering substances are staggering. For example, between the years "1988-1995 America spent $57.3 billion on drugs, of which $38 billion was on cocaine, $9.6 billion was on heroin and $7 billion was on marijuana" (Saah 2005). Although illegal drugs figure prominently, the cost of licit drugs such as alcohol and nicotine is considerable. Fifteen billion cigarettes are sold daily worldwide, with one in three cigarettes being consumed in the Western Pacific region. One in five teenagers aged between 13 and 15 smoke worldwide, with approximately 80,000 to 100,000 children starting smoking each day. Smoking-related deaths contributed to one tenth of global deaths, or four million deaths annually, with projected smoking-related deaths increasing to one in six by 2030 (Martin 2007).

Like tobacco addiction, alcohol addiction is a global problem, reaching crisis levels in some countries. High

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levels of alcohol-related disorders are in China, which has approximately 22% of the world's population. Since 1952, alcohol use in China has increased more than 50 fold (Cochrane et al. 2003). Approximately 100,000 deaths per year in the US are alcohol related, while youths who started drinking before 15 years of age are twice as likely to become alcoholics compared to those who did not start drinking before age 21 (Alcohol Addiction.info 2010).

The global popularity of alcohol is also partly attributed to social custom. For example, in Japan alcohol plays an important part in business culture and is readily accessed in vending machines. Chinese business practices also strongly feature alcoholic beverages. Different kinds of alcoholic beverages play an intrinsic part in human sociality. In Australia, adult and youth binge drinking is increasing. In Mediterranean countries that have historically been wine growing regions alcohol is a normalised part of everyday life.

Amphetamines are a type of synthetic stimulant in a class that includes methamphetamine and crystal methamphetamine (UNODC 2003; UNDCP 2001). Amphetamine was first synthesised in 1887 (Edelano 1887), while its chemical relative methylphenidate was developed in the early twentieth century (Baberg, Nelesen & Dimsdale 1996: 789). During the 1930s, amphetamine was prescribed for hyperactive children (Advokat 2007; Bradley 1937), and for the treatment of narcolepsy (Baberg, Nelesen & Dimsdale 1996:789), while British and American soldiers ingested benzedrine, and German and Japanese soldiers took methamphetamine in order to improve alertness (Stix 2009: 31). The use of amphetamines shifted during the post-war period and was geared towards dieters and recreational use (Baberg, Nelesen & Dimsdale 1996: 789). Methylphenidate, a close relative of amphetamines, emerged in 1956 and was promoted as a milder stimulant (Stix 2009: 32). By the 1960s approximately ten billion amphetamine pills had been prescribed worldwide (Stix 2009: 32). A 2007 United States National Survey on Drug Use and Health reported that approximately 13 million Americans from 12 years and older (5.3% of the population) had used methamphetamine at least once in their lifetime (Rose 2009). Misuse of amphetamine is widespread (second only to cannabis in the United Kingdom) and is associated with criminality (Brooke et al. 1998; Carnwath, Garvey & Holland 2002; Klee & Morris 1994; Klee 1997). Patients who have mental disorders such as schizophrenia tend to have high rates of amphetamine use (Menezes et al. 1996), and need frequent hospitalisation (Carnwath, Garvey & Holland 2002). Studies indicate that if nonhuman animals are given amounts of amphetamines at similar dosage levels used by human drug users that they can be susceptible to neurotoxicity to the "biome amine neurotransmitter systems" (Advokat 2007; Sonsalla et al. 1996; Villemagne et al. 1998). Repeated exposure to amphetamines generates long-term effects on the neostriatal dopamine system, amygdala and prefrontal cortex (Everitt & Wolf 2002; Nelson & Killcross 2006; Robinson & Kolb 1997). Several studies also indicate potential neurotoxic effects of repeated amphetamine use (McCann & Ricaurte 2004), especially in the treatment of attention deficit hyperactive disorder (ADHD), or the inducing of psychopathologic symptoms (McCann & Ricaurte 2004; Ricaurte et al. 2005; Volkow & Insel 2003).

The recreational use of the club drug Ecstasy by mainly White, middle class suburban youth has become a well-known phenomenon in western countries (Scott 2002: 5). Ecstasy (MDMA; 4-methylenedioxymethamphetamine) is a synthetic compound that is related to amphetamine. Ecstasy has been shown to have neurotoxic effects on 5-HT neurons in nonhuman animals (McCann et al. 1998; Semple et al. 1999), while higher MDMA levels reduce dopamine and homovanillic acid levels (Taffe et al. 2001). Ecstasy is a popular drug at rave parties, which have spread in mainstream youth culture, and may be used along with alcohol and other drugs. Common after effects of Ecstasy use include nausea, dizziness, disorientation, vomiting, stomach pains, blurred vision, muscle aches, numbness, irregular menstrual cycles, anxiety and panic attacks (Scott 2002: 5).

Giurgea first coined the term "nootropic" in the 1970s and believed in the ability of pharmacology to engineer a brain evolution (Giurgea 1972; Rose 2002). Nootropic drugs are becoming increasingly popularized in western countries. In a 2008 article in *Nature* a recent survey "showed that 20% of 1,427 respondents from 60 countries" reported their use of stimulants like modafinil, methylphenidate and beta blockers (Stix 2009: 30). A 2007 United States government survey revealed that 1.6 million people in the United States had used prescription stimulants (Stix 2009: 29). Although nootropic substances have been available for decades, they have recently been used by people in various vocational fields and age groups as a method of cognitive enhancement. For example, modafinil is widely used by American college students as it promotes alertness and mental focus (Sandberg & Bostrom 2006; Baranski et al. 2004; Randall et al. 2005; Turner et al. 2003; Teitelman 2001). Modafinil improves executive brain functions in "rested healthy adults, particularly inhibitory control, as well as enhancing spatial memory" (Greeley et al. 2008; Volkow et al. 2009). Other nootropic drugs such as Ritalin (methylphenidate) are being increasingly prescribed for ADHD, while adrafinil is prescribed for inducing mental focus, relieving excessive sleepiness and mood enhancement. Modafinil is increasingly becoming a "lifestyle" drug among students and young professionals. Stimulants like methylphenidate and dextro-amphetamine are also being prescribed for improving alertness among students and shift workers (Farah et al. 2004; Babcock & Byrne 2000). Ritalin is a stimulant used for treating ADHD in children. Introduced in 1956, ritalin is becoming increasingly popular among student populations in the United States. Ritalin has also been used at "ritalin

parties" where it is powdered and snorted, giving the party participants an "amphetamine boost."

HUMAN HISTORY OF PSYCHOTROPIC AND MOOD-ALTERING SUBSTANCES

Archaeological evidence suggests that *Homo sapiens* have been using various psychotropic substances since prehistory. Winkelman (2001: 339) asserts that Upper Paleolithic humans had an innate drive to experience altered states of consciousness via the use of psychotropic substances. Australian Aboriginal people used the plant pituri (*Duboisia hopwoodil*) for its nicotine content, as well as the plant *Nicotiana gossei*, which is a stimulant (Sullivan & Hagen 2002: 390; Watson 1983). As Aboriginal people have existed in Australia for well over 40,000 years it may be suggested that use of these native plants and others may be significant (Sullivan & Hagen 2002: 390). The use of *Sophora secundiflora* (mescal bean) was used by Paleolithic and Pleistocene people in western North America 10,000 years ago (Winkelman 1996). Similarly, cannabis use can be traced back in the Old World for a similar period (Winkelman 1996; Schultes & Hofmann 1979). Medicinal plants have also been found in the prehistoric burial site of the Shanidar cave in Iraq dating back over 50,000 years ago (Winkleman 1996). La Barre (1972) suggests that Paleolithic and Mesolithic mushroom cults were common to the ancestors of North American Indians, "Paleo-Siberian and Uralic cultures" (Winkelman 1996). Betel nut (*Areca catechu*) has been used by humans in South Asia and South-East Asia since the fourth century A.D.; betel is mentioned in Indian scripts such as the Bhavamista (thirteenth century) and Vagbhata (fourth century), as a therapeutic agent (Velayudhan, Kumar & Benegal No year). In the Americas, tobacco (*N. tabacum* and *N. rustica*) was widely used. The use of coca in the western Andes stems as far back as 7,000 years and in Ecuador 5,000 years (Sullivan & Hagen 2002: 390; Balick & Cox 1997). Prior to the arrival of Europeans into Africa, the use of khat (*Catha edulis*) was a well-established practice in Ethiopia and north-west Africa (Sullivan & Hagen 2002: 390). Hallucinogenic substances were administered in India as far back as the fifth millennia B.C.E. (Wink 1998). Hallucinogens such as *Atropa belladonna*, *Papaver somniferium*, and *Mandragora officinarum*, as well as 250 other plants were used by Assyrians (Wink 1998:12). Ancient Egyptians were using alkaloid plants such *Hyoscyamus niger*, pomegranate (*Punica granatum*), poppy (*Papaver somniferium*) and henbane (Wink 1998: 13; Baumann 1986; Gessner 1974; Mann 1992). By the third millennium B.C.E. as many as 365 drugs were recorded and used by the Chinese (Wink 1998).

The mind-altering effects of psychotropic plants are based on their chemical composition. The active chemical agents found in species of morning glory contain ergot alkaloids such as ergine and ergonovine, which are hallucinogenic. The hallucinogenic effects of the seeds *T. Corymbosa* (*Ololiúqui*) and *I. tricolor* are "closely related to d-Iysergic acid diethylamide (LSD)" (Furst 1976: 65). *Ololiúqui* was used by Aztec priests in Mexico. Tobacco used by South American Indians contains a high concentration of nicotine "a pyridime alkaloid that occurs in aboriginal species in much higher concentrations (up to four times) that in modern cigarette tobacco" (Furst 1976: 25). In addition, cannabis "contains more than 400 chemicals, of which the mind-altering component is tetrahydrocannabinol (THC)" (Papalia & Olds 1985: 124).

EVOLUTIONARY APPROACHES TO UNDERSTANDING HUMAN NEED FOR PSYCHOTROPIC AND MOOD-ALTERING SUBSTANCES

A central idea of evolutionary approaches to substance taking concerns the mismatch between biological evolution and cultural evolution. While biological evolution is based on natural selection and mutations in the gene pool, cultural evolution is incrementally faster and is posited on the novelty of the human mind. For example, the last 100 years has produced more technological innovation and understanding of matter than the last hundred millennia. Furthermore, natural selection does not "always match an organism's environment, especially where the environment transforms rapidly" (Lende & Smith 2002: 450). As Nesse (1999: 352) succinctly put it, cultural factors "change faster than our bodies can evolve." Therefore, using an evolutionary approach towards understanding human use of psychotropic and mood-altering substances leads us to some interesting scenarios. Firstly, in prehistory, natural drugs were always limited as a resource. This meant that there was "little activity of salient (wanting) behavior" (Saah 2005). Consequently, drug effects on the mesolimbic dopamine system were minimal, temporary and low intensity (Lende & Smith 2002:450). Secondly, human exploitation of a certain resource patch eventuated in diminished returns. In other words, contrived behaviors would no longer have been cost effective (Lende & Smith 2002: 450). Given the limited resource availability of natural drugs in the prehistoric environment there would have been minimal "pressure on the mesolimbic system" to regulate the excessive salience since this "was rarely a problem" (Lende & Smith 2002: 450; Nesse & Berridge 1997).

In modernity, human beings find themselves in novel environments with abundant food resources and easier lifestyles, which produce salient behaviors. For example, drug addiction gives a false signal of life fitness benefit, while displacing adaptive behaviors (Ness & Berridge 1997: 64). Using an evolutionary "mismatch" theory this is also characterized by western snack and fast foods which have supplanted more nutritious foods (Ness & Berridge 1997: 64). In further exploring the mismatch thesis, Nesse and Berridge (1997: 64) contend that there exists a neurological disparity between "liking" sweet foods (which is mediated

by the brain stem and opoid forebrain systems) and "wanting" sweet foods (which is mediated by the mesolimbic dopamine neurons). While the "liking" system is triggered by reward receiving, the "wanting" system is activated by anticipation of reward (Nesse & Berridge 1997: 64). The physiology of addiction may also be explained by "neural sensitization-hyposensitivity in ascending dopamine projections" that is gated by experiential and genetic factors (Nesse & Berridge 1997:64; Robinson & Berridge 1993).

A contesting theory of drug taking states that "pure psychoactive substances" were uncommon in the prehistoric environment (Sullivan & Hagen 2002). Secondly, for over a 200 million year period mammals have developed defenses to detoxify plant chemicals, as well as adaptive regimes to exploit their "adaptive potential" (Sullivan & Hagen 2002:390). It may be suggested that "human substance-seeking behavior" produced adaptive benefits due to exploiting plants during prehistory (Sullivan & Hagen 2002:390). Although substance seeking was an adaptive behavior in prehistory, it may not be construed as such in current societies (Sullivan & Hagen 2002). It is reasonable to assume that hominids may have evolved various adaptive responses in order to counter-exploit the benefits of psychotropic and mood-altering substances (Sullivan & Hagen 2002:397). This adaptive model posits that early *Homo sapiens* had an innate knowledge and context of psychotropic and mood-altering substances. Zoopharmacognosy studies note that humans are "content dependent" in relation to the natural world (Sullivan & Hagen 2002:398). On this note, Atran (1998), points out that there are cognitive universals among *Homo sapiens* that in this context may translate into an innate knowledge of the natural world. In this schema, "folk biology" which includes indigenous and traditional ways of taxonomising plant species may function as a "core meme."

The use of psychotropic and mood-altering substances may disrupt cognitive and affective behaviors by stimulating monoamines. However, Nesse (2002: 97) argues that plants that are natural pychotropics probably evolved these as toxins; their attraction to humans was more accidental than intentional. Whether exposure to psychotropic and mood-altering substances has been a part of natural selection in human beings is still unconfirmed. However, recent genetic research may be helpful here. The mutated gene that works on alcohol dehydrogenase (ALDH2*2) produces an adverse reaction in individuals when they drink alcohol. In this way, the gene may offer a protective function (Nesse 2002). Alternatively, the long period of drug taking by human beings may have informed certain features in human psychology that have maximized benefits and minimised costs (Nesse 2002).

Another evolutionary hypothesis is proffered by Hill and Chow (2002), which stipulates that ancestral use of psychotropic and mood-altering substances increases reproductive success among young males who sought to actively use them. According to these authors, environmental instability is a key factor for high alcohol intake by young males. In an unstable environment, early risk taking is geared towards early reproduction—a cost effective strategy (Hill & Chow 2002).

A fourth evolutionary approach stipulates that ancestral humans may have ingested psychotropic and mood-altering substances as food. While modern western societies categorize and conceptualize drugs as nonfoods, this kind of categorization is not consistent with the behaviors of indigenous and traditional people. For example, betel nut is chewed by people in Micronesia as a food (Sullivan et al. 2000). When chewers of betel nut were asked why they used it they responded that they used it to prevent fatigue rather than for its psychoactive effects (Sullivan & Hagen 2002:392). The blurring between drugs and food is also evident among the Yap and Chuuk in Micronesia who consider tobacco to be a food and beverage governed by taboo laws (Sullivan & Hagen 2002: 392; Marshall 1981). Among the Hausa of Nigeria, 107 plant species are used for gastrointestinal disorders, of which 50% (53) are also used as food (Sullivan & Hagen 2002; Etkin & Ross 1982). Studies conducted on the nutritional content of Bolivian coca leaf have found it exceeds the daily recommended amounts of vitamins A, B, and E (Sullivan & Hagen 2002:392). Similarly, the plant khat (which is regularly used by the Yemenis) contains 150 milligrams of vitamin C (per 100 grams of fresh leaves), as well as the trace elements niacin, riboflavin, thiamine, iron and carotene (Sullivan & Hagen 2002:392; Luqman & Danowski 1976).

These four evolutionary approaches provide different ideas towards understanding human use of psychotropic and mood-altering substances. Each approach suggests possible genetic and environmental influences for using such substances. While these approaches have been overviewed, their hypotheses have implications for the present debate on why ancestral and modern humans have taken and continue to take such substances. Possibly the most controversial approach is the mismatch theory. While drugs in their natural form were used by ancestral humans, their use was not ubiquitous (Sullivan & Hagen 2002:397). Also questionable is the mismatch approach's penchant to pathologising drugs and whether this is appropriate given "that the majority of human substance use is mundane exploitation of relatively unrefined plant products" (Sullivan & Hagen 2002: 397). Such pathologising is rightly asserted to be a "western preoccupation" and is not reflected by indigenous and traditional people's foraging and usage habits of psychotropic and mood-altering substances (Sullivan & Hagen 2002: 397).

ANTHROPOLOGICAL APPROACHES TO UNDERSTANDING HUMAN NEED FOR PSYCHOTROPIC AND MOOD ALTERING SUBSTANCES

Anthropological approaches to understanding human use of psychotropic and mood altering substances offer

a rich interpretive tool. Unlike evolutionary approaches, an anthropology of substance taking emphasizes social mechanisms and seeks to explain human behaviors and the symbolic meanings that individuals employ.

Winkelman's long-standing engagement with shamanism (2006; 2004a, b; 2002a, b; 2001; 2000; 1996; 1990) and altered states of consciousness provides readers with a unique insight into shamanistic behavior. According to Winkelman (1996), the use of psychotropic plants foregrounds the importance of neurophenomenology and ethnic studies. Winkelman uses the word "psychointegrator" for psychotropic substances. Psychointegrators evoke powerful emotions and spiritual experiences that have been contoured by thought and practice. As Winkelman (1996: 10), states: "Understanding of these substances from biophysiological through psychocultural levels has nonetheless advanced considerably in the last decades."

The use of psychotropic substances is widespread in shamanic and traditional societies (Wilcox 2003; Roberts 2001; Saniotis 2001; Luna & White 2000; Davis 1999; Metzner 1999; Polari de Alverga 1999; Schultes, Hoffmann & Ratsch 1998; Forte 1997; McKenna 1992; Schultes 1988; Dobkin de Rios 1984, 1972, 1970, 1968-1969, 1968; Joralemon 1984; Davis 1983; Davis & Yost 1983; Sharon & Donnan 1977; Reichel-Dolmatoff 1975; Myerhoff 1974; Harner 1973; Pinkley 1969). The use of psychotropic substances has pronounced effects on neurological processes and informs affective and perceptual modalities. One reason for this is the similarity between psychotropic substances and neurotransmitters (Winkelman 1996; Hoffmeister & Stille 1982). Popular psychotropic substances are *Banisteriopsis caapi* (ayahuasca), mescaline, cannabis, peyote, and psilocybin mushrooms. The chemical composition of these substances has "inhibitory effects on the mesolimbic temporal lobe" and the "raphe cell regulation of the visual cortex" (Winkelman 2000). While some psychotropic substances cause sympathetic arousal, they eventually dominate the parasympathetic system (Winkelman 2000). A fundamental role of psychotropic use is to induce altered states of consciousness (ASC), which is central to shamanic healing and religious practices (Winkelman 1996). ASC are significantly featured in ritual initiations and healing ceremonies and facilitate the transmission of esoteric knowledge and vision states. ASC are often induced by rhythmic bodily movements, chanting, singing, drumming and dancing, fasting and sensory deprivation. Some shamanic rituals may incorporate several of these elements, which assist in eliciting endogenous opoids (Winkelman 2002a: 1880). A good example of this syncresis of elements that foster ASC is the *Khomba* girl's initiation ritual among the Tsonga of South Africa. Preceding the administering of the psychotropic plant *Datura fastuosa*, the initiates are made to dance together vigorously (Johnson 1977). The rhythmic movements of the initiates compounds the hallucinogenic effect of the psychotropic plant. Moreover, Neher (1962) points out that dancing can affect the production of adrenaline via the arousal of the sympathetic system.

According to anthropologists Michael Harner and Barbara Myerhoff, ASC access metaphysical realms or "inner worlds" that are connected to shamanic deities and animal powers (Mentzner 1998). La Barre (1972) contends that the use of psychotropic substances in their capacity to generate ASC validates religious traditions. The reason for this is that psychotropic substances may elicit inner experiences and assist in disclosing features of human consciousness. Psychotropic substances are considered as being crucial for communicating with the supernatural world (Winkelman 1996). In shamanic societies the supernatural realm guides subjective experience and may lead to a transformation of consciousness (Winkelman 1996:20). Unlike the profane realm, the sacred realm is invested with extraordinary power which may be accessed during ASC. Accessing the sacred realm may also lead to an abreaction of anxiety symptoms, leading to a psychological catharsis (La Barre 1972: 262). Therefore, the use of psychotropic substances may enhance "societal defense mechanisms" (Winkelman 1996), especially during social and subjective crisis (La Barre 1972: 265).

The use of psychotropic substances to induce ASC is usually conducted by shamanic healers who guide ritual participants into understanding their ASC. What is important here is that ASC may generate independent discovery and creativity (Winkelman 1996: 21). To use Victor Turners's idea, psychotropic-induced ASC may promote liminal type experiences; liminality being a source of personal creativity and transformation (Turner 1969). This kind of liminal experience is evident in various shamanic societies. For example, the use of peyote by Huichol Indians during their pilgrimage to Wirikuta induces a state of unity with Huichol deities (Myerhoff 1974). Among the Navajo, peyote is central to healing ceremonies, which enables participants to become receptive to the "teachings of peyote," fostering reflexivity (Calabrese 1994:505). In this instance, peyote is considered as being a teacher who guides the ritual participants to the inner mysteries. In other words, peyote is conceptualized as a sentient and reflexive being that mediates human conscious and unconscious states. The use of *Banisteriopsis caapi* among South American Indian tribes is also significant. The plant is made into a beverage called ayahuasca. An interesting feature of ayahuasca is the homogeneity of visions between users from different tribes; common visions include pythons, snakes and jaguars (Harner 1962: 260-261). Ayahuasca shamanic ceremonies usually consist of a small group who sit in semi darkness while the shaman sings specific songs called *icaros*. The singing of *icaros* incorporates rapid rhythms, which assist in maintaining the flow of experience (Mentzner 1998: 5).

In India, I examined the use of cannabis among Indian sufis. The smoking of cannabis is often conducted in a group. The actual cannabis plant is made into blocks of

cannabis resin. The resin is placed into a small pipe called a *chillum* and then smoked. Sufis usually incorporate *nara* during the smoking of a *chillum. Nara* are spontaneous expletives which are endowed with religious meaning, and are used to invoke the assistance of Muslim saints. *Nara* are usually performed in the proximity of Muslim shrines and are considered to be venerational acts (Saniotis 2001: 362). Such acts objectify a sufi's mystical relationship with the saints called *hukm* (Saniotis 2001). *Nara* are uttered aloud and are regularly accompanied by the waving of arms and shaking which are synonymous with ASC (which is called *hal*). The hyperbolic behaviors expressed during *nara* are highly prized by sufis since they convey a sufi's intimacy with the saints (Saniotis 2001). The truculent vocalisations of a sufi's *nara* are often joined by other sufis who may also join in expleting their own *nara* while experiencing ASC. Therefore, cannabis use in conjunction with *nara* reaffirms the sufis' mystical identity.

CONCLUSION

In this article I have proposed to analyse the use of psychotropic and mood-altering substances using evolutionary and anthropological approaches in order to broaden our understanding as to why such substances have been and are presently used. While both approaches speculate about different notions of psychotropic and mood altering substance use, I argue that they may further promote discussion in this area of human behavior. The widespread use of psychotropic and mood-altering substances among *Homo sapiens* demands rigorous theoretical attention, especially because of its impact on individuals and societies. For this reason researchers should utilize various theoretical approaches in order to foster new ways of understanding substance use and abuse. As I have shown, since prehistory human beings have had a close association with various kinds of psychotropic and mood-altering substances. Such substances have served several purposes, such as inducing ASC for religious and recreational purposes, cognitive enhancement, strengthening group identity, reproductive success, and food. Given their current prevalence, psychotropic and mood-altering substances will continue to have a considerable impact on future human societies.

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